DOCUMENT RESUME

VT 007 836

ED 026 539

By-Finch, Curtis R.

The Development of an Instrument to Measure Student Attitude Toward Individualized Shop and Laboratory Instruction. Vocational-Industrial Education Research Report. Research Series No. 2.

Pennsylvania State Dept. of Public Instruction, Harrisburg. Bureau of Vocational, Technical, and Continuing Education.; Pennsylvania State Univ., University Park. Dept. of Vocational Education.

Pub Date Jan 69

Note-21p.

EDRS Price MF-$0.25 HC-$1.15

Descriptors-*Attitude Tests, Individualized Curriculum, *Industrial Education, School Shops, Secondary School Students, *Student Attitudes, *Teaching Methods, Test Reliability, Test Validity

Identifiers-*Shop and Laboratory Attitude Inventory

The primary objective of this study was to develop an instrument to measure student attitudes toward individualized and laboratory instruction during a specific period of instruction such as an hour, day, week, or month. Positive and negative statements relating to these attitudes were developed and screened by five professors. The resulting 50 statements were randomly ordered and a Likert scale was used to collect student responses. Pilot test results involving 60 students were item analyzed and three items were deleted. A reliability coefficient of .918 and a mean intra-item correlation of .18 were obtained. Other statistical tests were conducted using other students. The "Shop and Laboratory Attitude Inventory" is included. (EM)

ED0265539

VOCATIONAL
EDUCATION
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THE DEVELOPMENT OF AN INSTRUMENT TO MEASURE STUDENT ATTITUDE TOWARD INDIVIDUALIZED SHOP AND LABORATORY INSTRUCTION

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VOCATIONAL – INDUSTRIAL EDUCATION Research Report

RESEARCH SERIES, NUMBER 2

JANUARY, 1969

VT007538

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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THE DEVELOPMENT OF AN INSTRUMENT TO MEASURE STUDENT ATTITUDE TOWARD INDIVIDUALIZED SHOP AND LABORATORY INSTRUCTION.

Vocational-Industrial Education Research Report.

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The research reported herein was partially supported by the Bureau of Vocational, Technical, and Continuing Education, Pennsylvania Department of Public Instruction, Harrisburg.

RESEARCH SERIES, NUMBER 2 JANUARY, 1969

ACKNOWLEDGEMENTS

A number of persons have made meaningful contributions to this study. The investigator would particularly like to express gratitude to those colleagues in the Department of Vocational Education who critically reviewed the instrument and made constructive evaluations.

The cooperation of personnel in local vocational-technical programs was also gratifying. Those who provided facilities and students for the administration of the instrument included: Edward Thomas, Dean Gwin, and George Johnson, Tyrone School District; Merrill Alexander and John Alexander, Centre County Area Vocational Technical School; Robert Fike and Robert Charles, Clearfield Area High School.

Additional data for the study was obtained through the cooperation of in-service teachers enrolled in Methods in Examinations which was taught at the Williamsport Area Community College during the Spring 1968 Term. These persons were Larry Clark, Glen Getchen, Forrest Johnson, Neal McCormick, Jackie Welliver, and Donald Young.

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January, 1969

INTRODUCTION

The past decade has seen a proliferation of research focusing upon learning outcomes. Many of the investigations conducted, despite excellent design and execution, have suceeded in producing large amounts of unexplained variance. Obviously, if the effects of task related variables are removed from a study and unexplained variance is still present, the source of this variance should be identified.

One non-cognitive variable which appears to account for unexplained variance in learning behavior is student attitude. As indicated by Krathwohl, et. al. (1964),

> "Some of the more interesting relationships between the cognitive and affective domains (and some of the clearer indications of the interrelatedness of the two domains) are those in which the attainment of a goal or objective of one domain is viewed as the means of attainment of a goal or objective in the other."

Investigations attempting to relate attitude and learning have given support to this assumption. Some evidence exists that attitudes toward school, feelings of self-confidence, and achievement goals tend to enhance learning effectiveness (Jackson and Strattner, 1964).

Nevertheless, exact relationships between student attitude and learning behavior have not yet been ascertained. This is particularly the case with regard to student attitude and individualized instruction since most research has focused upon students in a typical classroom environment. Fortunately, however, there have been a number of investigations dealing with student attitude toward newer forms of individualized instruction (i.e. programed instruction) which show some relevance to the question at hand.

An investigation conducted at IBM (Hughes and McNamara, 1961) compared conventional classroom instruction with programed instruction in the

training of computer service personnel. Eighty-seven per cent of the students indicated that they liked the programed instruction better than conventional teaching. Eighty-three per cent favored using programs in the future and ninety-three per cent thought that learning from programs was less difficult than from conventional instruction. A comparison of the use and acceptance of programed materials in biology with other materials and techniques was made by Englemann (1963). One hundred and sixty-seven students were asked to evaluate the effectiveness of various methods in preparing them for examinations. Twenty-eight per cent of the students thought that the programed materials were "absolutely essential" while thirty-six per cent thought they they were "helpful ninety per cent of the time." A similar study conducted by Smith (1962) utilized an intrinsic program to teach elementary statistics. Students using the programed text indicated that they enjoyed the material but less than sixty per cent preferred it over conventional teaching and thought they learned with less effort from the program.

Some investigations dealing with programed instruction have examined relationships between student attitude and achievement variables. As part of a large scale research study of methods and media for presenting courses in mathematics and English (Carpenter and Greenhill, 1963), four different rates of presentation in programed algebra were given by filmstrip projection. After the completion of the last unit test, subjects responded to a unidimensional attitude scale. Results indicated that the variations of pace produced no significant differential effects with respect to attitude toward the method of instruction. The findings suggest that individuals may have wide tolerance limits for variations of the pacing of their learning, and that pacing within limits is not critical to program effectiveness. A study of Eigen and Feldhusen (1964) focused on some of the

possible interrelationships among attitude, achievement, and intelligence variables in programed instruction. The authors found that students' attitudes toward programed instruction were not generally related with their success in learning or transfer from the program. In the progression from 9th to 11th grades, attitudes became increasingly correlated with learning. Study methods and general attitude toward school were not correlated with learning scores. Hough and Revsin (1963) studied several factors influencing learning by programed instruction at the college level. No significant differences were found between high and low achievers in their attitudes toward programed instruction. Wodtke, Mitzel, and Brown (1965) investigated student reactions to individualized computer assisted instruction. Following an initial session of computer assisted instruction each student completed a student reaction inventory which was modeled after Osgood's Semantic Differential. Attitude scores indicated that some students were highly motivated to do well in the course while others were flustered by the machinery. Additionally, a correlational analysis was made between student program errors, rate of performance, ability scores, cumulative grade point average, personality score and score on the student reaction inventory. The correlations generally indicated that students having lower cumulative grade points and lower ability scores tended to rate the course and machine as fast. The data suggested that computer assisted instruction employing optional delays, optional review, and optional remedial work would be benificial for some students. In a study conducted by Dwyer (1968) student perceptions of the instructional value of visual illustrations used in a programed textbook were compared with data resulting from a criterion test covering the instructional content. It was concluded that student perceptions probably do not provide a valid indication of the instructional value of visual illustrations used in programed isntruction.

Doty and Doty (1964) indicated that achievement in programed instruction might be related to individual personality characteristics. A high positive correlation was found between grade point average and attitude.

In a study which is perhaps more applicable to shop and laboratory instruction (Wills, 1965) the effects of teaching shop procedures emphasizing speed of performance were examined. Results indicated that students exposed to speed of performance procedures did not differ appreciably in their attitudes toward the course being taken from a group which received no emphasis. It was noted, however, that the speed of performance group produced a greater quantity of work with more errors and less economy of materials.

The foregoing indicates that some progress has been made in the study of student attitude as related to individualized instruction. Difficulty, however, has been encountered in the identification of specific meaningful relationships between attitude and learning. Much research has seemed to focus on attitude per se rather than examining it as an intervening variable between the stimulus situation and the behavioral outcome. Additionally, conclusions may not be drawn about attitude toward shop and laboratory instruction because few investigations have been conducted in this area.

Central to this problem is the development of measures which can be utilized to accurately assess student attitude. As indicated by Moss (1967), "important problems are usually complex and become persistent because we lack the tools--the research techniques and instruments--necessary to solve them."

The obvious lack of relevant research in vocational, technical, and pratical arts education suggests that there is a need for an instrument which can be used to measure student attitude toward individualized shop

and laboratory instruction. Such an instrument might have utility in the evaluation of different instructional treatments as well as possible prediction of teacher and student behavior. An extensive review of attitude measurement literature failed to identify an existing instrument which could be utilized for such intended purposes.

The primary objective of this study then was to develop an instrument which would accurately measure student attitude toward individualized shop and laboratory instruction. In order that the instrument could accurately focus upon shop and laboratory environment, certain limitations were imposed. First, it was specified that attitude toward individualized instruction be measured. The student is usually "on his own" while in a shop or laboratory and may be more involved with instruction (i.e., equipment, tools) than with the instructor. In either case he is involved on an individual basis rather than as a member of a class such as would be found in a classroom situation. It was, therefore, felt that a student's involvement with instruction outside the classroom is individualized and should be treated accordingly.

Second, it was felt that the instrument should measure student attitude toward a specific period of instruction (i.e., hour, day, week, month, etc.) which he had just completed. In other words, the instrument would be a specific attitude measure rather than an omnibus measure. In this way it would be more sensitive to treatment differences in experimental situations.

CONSTRUCTION

As a basis for instrument development a psychological objective was specified as student attitude toward practical individualized shop and laboratory instruction. Statements which related to the objective were

then constructed and edited based upon criteria suggested by Edwards (1957). In order to reduce response set, the statements developed were both positive (favorable) and negative (unfavorable).

An initial evaluation of the statements was performed by a jury of five persons who were Penn State Department of Vocational Education staff members. Jury members were asked to indicate whether each item was worded correctly and was positive or negative with regard to the established objective. Fifty statements were selected from the final decision of the jury. Of these, twenty-five statements were positive and twenty-five negative. Statements were randomly ordered and placed on forms together with a five point scale ranging from strongly agree to strongly disagree (Likert, 1932).

The summated (Likert-type) scale was chosen for several reasons. First, several degrees of expression (agreement-disagreement) are permitted. This range of responses to an item provides more precise information about the individual's attitude referred to by the given item. Second, the summated scale lends itself to empirical analysis. Items which are found to be consistent with the total score can be included, whereas, other methods rely upon agreement among judges. Third, the Likert-type scale has great potential in the determination of content validity. If items are intercorrelated and factor analyzed, attitudinal factors may then be isolated and identified (Kerlinger and Kaya, 1959).

EVALUATION

In order to appraise the inventory which had been constructed, evaluations were made of instrument validity, reliability, unidimensionality, and discrimination.

Unidimensionality

The inventory was initially administered to sixty vocational auto mechanics students who had just completed a three hour period of automotive shop instruction. The total group consisted of sophmores, juniors, and seniors attending two high schools. In order to ascertain instrument homogeneity, the student score on each item was correlated with the total scale score (Adams, 1964). It was hypothesized that items having low positive or any negative correlation with the total scores were not contributing to scale homogeneity or unidemensionality. The internal consistency method of item analysis resulted in subsequent elimination of three items. All other items correlated significantly ($P<.05$) with the criterion using a one-tailed test of significance. The forty-seven item instrument is presented in Appendix A.

In order to further investigate unidimensionality, item correlations were subjected to principal components factor analysis and varimax rotation It was specified that six factors be extracted from the correlation matrix. Factor variance in order of extraction is presented in table 1.

TABLE 1

FACTOR ANALYSIS OF ATTITUDE SCALE ITEMS

FACTOR	PER CENT OF VARIANCE ACCOUNTED FOR BY FACTOR
1	11.446
2	3.556
3	2.977
4	2.527
5	2.448
6	2.182

The amount of variance accounted for by the first factor gave some indication that the scale was measuring one attitude dimension. It appeared that the inventory was basically measuring student attitude toward instruction on one dimension as specified by the originally developed objective. Recognizing the shortcomings of the Likert-type scale in terms of theoretical rationale it was felt that total score, which was identified as being unidimensional in nature, could provide a basis for ordering of people on the characteristic being measured (Selltiz, et. al., 1959).

Reliability

Item reliability was computed using the analysis of variance technique. This method is equivalent to the Kuder-Richardson 20 coefficient (Guilford, 1959). As indicated in Table 2, the reliability obtained was .918 with a mean intra-item correlation of .18.

TABLE 2

ATTITUDE INVENTORY ANALYSIS OF VARIANCE RELIABILITY:
60 HIGH SCHOOL AUTO MECHANICS STUDENTS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARES
Subjects	59	476.16	8.076
Items	49	173.86	
Residual	2891	1904.59	0.6588

R=1-0.659/8.071=0.918

Based upon the number of items and the sample size utilized, it appears that the inventory has a relatively high degree of internal consistancy reliability.

Stability measures "how nearly constant the scores are likely to be if a test is repeated after time has lapsed" (American Psychological Association, 1966). It should be noted, however, that stability reliability is deemed inappropriate for this particular instrument. An obvious reason is that the inventory was designed to measure student attitude toward a specific period of shop or laboratory instruction. Since each period of instrucion is in itself rather unique, it is impossible to replicate the activities and environment which a student has been exposed to.

Discrimination

In order to determine whether or not the inventory would discriminate adequately in an experimental situation, a group of twenty-eight high school auto mechanics students were randomly assigned to two treatments. Thirteen of the students worked on automobiles in the shop while fifteen students studied textbooks at their desks. After approximately fifty minutes, the attitude instrument was administered to the collective sample. Analysis of the difference between treatment attitude score means resulted in a t value of 4.4517 which favored the shop treatment beyond the .001 level of significance.

Validity

An additional aspect of analysis was concerned with validity. The fact that items were developed and selected because of their relevance to a specific objective indicates that content validity is present. This was further confirmed by the primary clustering of items around one factor when items were factor analyzed. Results of the reliability check give additional evidence that the instrument content is valid (there is one psychological object).

In order to ascertain whether the inventory had some degree of predictive validity, attitude scores of twenty-five auto mechanics students were correlated with their end of term grades. The length of time between attitude instrument administration and grade determination was approximately five weeks. Scores were obtained from part of the original group that had completed the instrument. It was hypothesized that there would be a positive correlation between attitude and subsequent course achievement. A correlation of .469 between the two variables was found. This was significant at the .01 level for a one-tailed test. Results indicate that the inventory may have some utility in predicting future aspects of behavior. It might well be that a student's attitude is relatively stable; that is, his attitude on one day may be similar to his attitude the following day. Certain characteristics related to the student's attitude toward individualized instruction may be observed by the instructor. These observations might eventually contribute to the instructor's subjective determination of a grade.

Consideration should also be made for the fact that involvement with different types of instruction may produce different reactions. Some justification for this idea was made in the previously discussed discrimination analysis.

Cross-Validation

In order to determine if the data obtained from the first sample was truly effective, a cross-validation study was conducted using another independent, but similar, sample of students. The separate sample consisted of 115 students who were enrolled in post-high school vocational and technical programs at a community college. The courses in which the students were enrolled included machine shop (n=44), auto body (n=17), drafting (n=15),

blueprint reading (n=18), and welding (n=21). Table 3 indicates an internal consistency reliability of .931. The mean intra-item correlation for the cross-validation study was .224.

TABLE 3

ATTITUDE INVENTORY ANALYSIS OF VARIANCE RELIABILITY:
115 POST-HIGH SCHOOL STUDENTS IN FIVE COURSE AREAS

SOURCE	DF	SUM OF SQUARES	MEAN SQUARES
Subjects	114	1315.82	11.5423
Items	46	434.81	
Residual	5244	4161.15	0.7935

R=1-0.794/11.542=0.931

Results of the cross-validation administration give further evidence that the instrument has a high degree of reliability and that reliability is not appreciably affected by combined student groups from different subject areas. The high reliability among students in different course areas reflects the identification of a common attitude element, thus confirming the instrument's validity.

IMPLICATIONS

Based upon research needs, an instrument was developed to measure student attitude toward individualized shop and laboratory instruction. The results of a series of field trials indicated that the instrument was unidimensional in nature and contained sufficient validity and reliability for intended purposes.

Utilization of the instrument in future research and development

activities will serve two purposes. First, a more accurate assessment of student attitude toward individualized shop and laboratory instruction may be obtained. Equally important, however, is the fact that student attitude may be examined as a potential contributor to learning outcomes in the shop and laboratory.

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APPENDIX A

SHOP AND LABORATORY ATTITUDE INVENTORY

SHOP AND LABORATORY ATTITUDE INVENTORY

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DIRECTIONS: Below are several statements about the period of instruction which you have just completed. Read each statement carefully and indicate the degree to which you agree or disagree with it according to the following scale:

SD - Strongly Disagree - I strongly disagree with the statement.

D - Disagree - I disagree with the statement, but not strongly so.

N - Neutral - I am neutral toward the statement or don't know enough about it.

A - Agree - I agree with the statement, but not strongly so.

SA - Strongly Agree - I strongly agree with the statement.

CIRCLE YOUR RESPONSE	..Strongly Disagree	..Disagree	..Neutral	..Agree	..Strongly Agree
1. I would like more instruction presented in this way.....	SD	D	N	A	SA
2. I learned more because equipment was available for me to use.....	SD	D	N	A	SA
3. This instruction was very boring.....	SD	D	N	A	SA
4. The material presented was of much value to me.....	SD	D	N	A	SA
5. The instruction was too specific.....	SD	D	N	A	SA
6. I was glad just to get through the material.....	SD	D	N	A	SA
7. The material presented will help me to solve problems...	SD	D	N	A	SA
8. While taking this instruction I almost felt as if someone was talking with me.....	SD	D	N	A	SA
9. I can apply very little of the material which I learned to a practical situation.....	SD	D	N	A	SA
10. The material made me feel at ease.....	SD	D	N	A	SA
11. In view of the time allowed for learning, I felt that too much material was presented.....	SD	D	N	A	SA
12. I could pass an examination over the material which was presented.....	SD	D	N	A	SA

		..Strongly Disagree	..Disagree	..Neutral	..Agree	..Strongly Agree
13.	I was more involved with using equipment than with understanding the material.....	SD	D	N	A	SA
14.	I became easily discouraged with this type of instruction.....	SD	D	N	A	SA
15.	I enjoy this type of instruction because I get to use my hands.....	SD	D	N	A	SA
16.	I was not sure how much I learned while taking this instruction.....	SD	D	N	A	SA
17.	There are too many distractions with this method of instruction.....	SD	D	N	A	SA
18.	The material which I learned will help me when I take more instruction in this area.....	SD	D	N	A	SA
19.	This instructional method did not seem to be any more valuable than regular classroom instruction.....	SD	D	N	A	SA
20.	I felt that I wanted to do my best work while taking this instruction.....	SD	D	N	A	SA
21.	This method of instruction makes learning too mechanical.....	SD	D	N	A	SA
22.	The instruction has increased my ability to think.....	SD	D	N	A	SA
23.	I had difficulty reading the written material that was used.....	SD	D	N	A	SA
24.	I felt frustrated by the instructional situation.....	SD	D	N	A	SA
25.	This is a poor way for me to learn skills.....	SD	D	N	A	SA
26.	This method of instruction does not seem to be any better than other methods of instruction.....	SD	D	N	A	SA
27.	I am interested in trying to find out more about the subject matter.....	SD	D	N	A	SA
28.	It was hard for me to follow the order of this instruction.....	SD	D	N	A	SA
29.	While taking this instruction I felt isolated and alone.....	SD	D	N	A	SA

		..Strongly Disagree	..Disagree	..Neutral	..Agree	..Strongly Agree
30.	I felt uncertain as to my performance in the instruction.....	SD	D	N	A	SA
31.	There was enough time to learn the material that was presented.....	SD	D	N	A	SA
32.	I don't like this instruction any better than other kinds I have had.....	SD	D	N	A	SA
33.	The material presented was difficult to understand.....	SD	D	N	A	SA
34.	This was a very good way to learn the material.....	SD	D	N	A	SA
35.	I felt very uneasy while taking this instruction.....	SD	D	N	A	SA
36.	The material presented seemed to fit in well with my previous knowledge of the subject.....	SD	D	N	A	SA
37.	This method of instruction was a poor use of my time.....	SD	D	N	A	SA
38.	While taking this instruction I felt challenged to do my best work.....	SD	D	N	A	SA
39.	I disliked the way that I was instructed.....	SD	D	N	A	SA
40.	The instruction gave me facts and not just talk.....	SD	D	N	A	SA
41.	I guessed at most of the answers to problems.....	SD	D	N	A	SA
42.	Answers were given to the questions that I had about the material.....	SD	D	N	A	SA
43.	I seemed to learn very slowly with this type of instruction.....	SD	D	N	A	SA
44.	This type of instruction makes me want to work harder.....	SD	D	N	A	SA
45.	I did not understand the material that was presented.....	SD	D	N	A	SA
46.	I felt as if I had my own teacher while taking this instruction.....	SD	D	N	A	SA
47.	I felt that no one really cared whether I worked or not.....	SD	D	N	A	SA